

Introduction

Acids and bases are electrolytes that produce a specific type of ion in water solution.

1) Acids will produce _____

Hydrogen ions are also called _____

2) Bases are electrolytes that generally produce hydroxide ions (OH^{-1}).

A product of an acid and a base is a _____

Acids

l General Properties

- » _____
- » _____
- » _____
- » _____
- » _____
- » _____

l Three definitions:

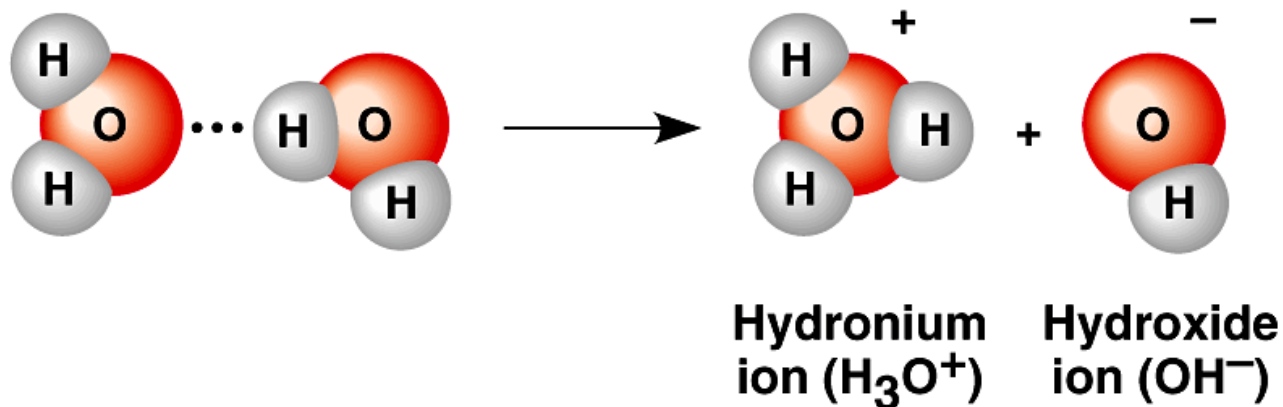
- » Traditional- _____

- » Brønsted- _____

- » Lewis- _____

└ Types of aqueous acids

- » When we have water involved and hydrogen ions are produced, a new ion comes about.
- » It is basically a hydrated hydrogen ion called a hydronium ion which looks like this:



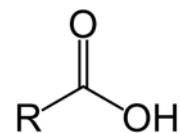
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Terms given to acids:

- » Strong acid refers to a compound that is _____

- monoprotic acids can donate _____
 - └ Examples _____
- diprotic acid can donate _____
 - └ Example: _____
- polyprotic: any acid can donate _____
- » Weak acids are also _____
 - Examples: _____
- » Organic acids are _____

Functional group called a carboxyl look like this:



l Names & structures of common acids

- » Binary acids - _____
 - All begin with _____
 - Name root of second element and add suffix _____
 - Example: HCl-_____
- » Oxyacids- _____
 - Named by adding prefix & suffix to root of third element

Some of the oxyacids have differing amounts of oxygen.

- ↳ They are differentiated by prefixes & suffixes:

- » Examples:
- | | | | |
|---------------------|---------------------|------------------|----------------|
| - HClO | hypochlorous | HNO ₃ | nitric |
| - HClO ₂ | chlorous | HNO ₂ | nitrous |
| - HClO ₃ | chloric | | |
| - HClO ₄ | perchloric | | |

Common Acids

l Strong inorganic acids

Acid	formulas	what the compound is used for:
hydrochloric		
sulfuric		
nitirc		

l Medium to weak inorganic acids

Acid	formulas	what the compound is used for:
boric		
carbonic		
hydrofluoric		
phosphoric		

Weak organic acids

Acid	formulas	what the compound is used for:
Acetic		
Benzoic		
Butyric		
Formic		
Lactic		
Malic		
Citric		

Acid anhydrides

l The word anhydride means with _____

l Acid anhydrides are:

» Nonmetal oxides that form acids when they react with water



» Nonmetal oxides are formed when water is removed.



Bases

l General properties of bases:

- » _____
- » _____
- » _____
- » _____
- » _____
- » _____

l Definitions of bases:

- » Traditional- _____

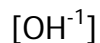
- » Brønsted - _____

- » Lewis - _____

l Types of bases:

» Strong bases produce a lot of _____ in solution

– The hydroxide looks like this:



– Hydroxides are usually made of the _____ that are soluble in water

» Weak bases produce _____ numbers of hydroxide ions in water such as ammonia

Strong Bases

↳ Strong bases dissociate 100% into the cation (metal ion) and OH⁻ (hydroxide ion).

The hydroxides of the Group I and Group II metals usually are considered to be strong bases.

» LiOH - _____

» NaOH - _____

» KOH - _____

» RbOH - _____

» CsOH - _____

↳ * Ca(OH)₂ - _____

↳ * Sr(OH)₂ - _____

↳ * Ba(OH)₂ - _____

↳ * These bases completely dissociate in solutions of 0.01 M or less. The other bases make solutions of 1.0 M and are 100% dissociated at that concentration.

Common Bases

↳ Sodium hydroxide (NaOH) or caustic soda

↳ Calcium hydroxide (Ca(OH)₂) or limewater

↳ Ammonium hydroxide (NH₄OH) or ammonia water

↳ Magnesium hydroxide (Mg(OH)₂) or milk of magnesia

↳ Many bleaches, soaps, toothpastes and cleaning agents

Weak Bases

↳ Example of weak base include ammonia, NH₃,

↳ Most weak bases are of _____.

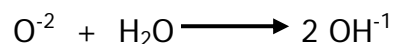
↳ Weak bases do not furnish OH⁻ ions by dissociation.

Instead, they react with water to generate OH⁻ions.

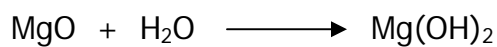
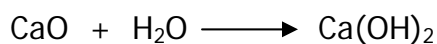
↳ are:

» Metal oxides that react with water to produce a solution that contains hydroxide ions

» Generally:



Examples:



Conjugate acid/base pairs

↳ Brønsted theory allows for the study of protolysis

» Proton transfer reactions.

↳ To Review:

» Acids can _____protons

» Bases can _____protons

Conjugate acid/base pairs

↳ A conjugate base is:

» What remains of an ion or molecule after it _____
and the ion or molecule may now _____

↳ A conjugate acid is:

» What remains after an ion or molecule _____
» and can now _____

Conjugate acid/base pairs

Examples of Brønsted conjugate acid-base pairs

Acid	Base
HSO_4^{-1}	
	Cl^{-1}
H_3O^{+1}	
$\text{H}_2\text{PO}_4^{-1}$	

pH & pOH

Another method of determining acid/base concentration is by _____

The scale _____

Mathematically pH & pOH are calculated by:

» $\text{pH} = -\log [\text{H}^{+1}]$

– the brackets [] mean concentration in moles per liter

» $\text{pOH} = -\log [\text{OH}^{-1}]$

» And $\text{pH} + \text{pOH} = 14$

Acid-Base Indicators

Acid-Base indicator defined.

» An acid-base indicator is a _____

» The undissociated form of the indicator is a _____
_____ the indicator.

» An indicator does not change from pure acid to pure alkaline at a specific
hydrogen ion concentration, but a _____

This range is termed the _____.

» This range is expressed as _____

Use of an Acid-Base indicator.

- » Weak acids are titrated in the presence of indicators that change under slightly alkaline conditions.
- » Weak bases can be titrated in the presence of indicators that change under slightly acidic conditions.

Some pH indicators

Indicator	pH Range	Acid Color	Base Color
Thymol Blue	1.2 – 2.8	red	yellow
Methyl yellow	2.9 – 4.0	red	yellow
Methyl orange	3.1 – 4.4	red	orange
Bromophenol blue	3.0 – 4.6	yellow	blue-violet
Methyl red	4.4 – 6.2	red	yellow
Bromophenol blue	6.2 – 7.6	yellow	blue
Phenol red	6.4 – 8.0	yellow	red
Thymol blue	8.0 – 9.6	yellow	blue
Phenolphthalein	8.0 – 10.0	colorless	red
Alizarin yellow	10.0 – 12.0	yellow	lilac

Neutralization Reactions

- ⌞ When an acid and a base react, they will produce _____
 - » acid + base \longrightarrow H₂O + a salt
- ⌞ In a neutralization reaction, _____

- ⌞ However, one mole of any acid will not necessarily neutralize one mole of base.

What are Salts?

- ⌞ Salts are the non-water product of an acid base neutralization. There are four possible acid base reactions that produce salts.
- ⌞ They are the reaction of a:
 - 1) _____
 - 2) _____
 - 3) _____
 - 4) _____

Example reactions of each are:

- 1) $\text{HCl} + \text{NaOH} \rightarrow \text{Na}^+ + \text{Cl}^- + \text{H}_2\text{O}$
- 2) $\text{HC}_2\text{H}_3\text{O}_2 + \text{NaOH} \rightarrow \text{Na}^+ + \text{C}_2\text{H}_3\text{O}_2^- + \text{H}_2\text{O}$
- 3) $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4^+ + \text{Cl}^-$
- 4) $\text{HC}_2\text{H}_3\text{O}_2 + \text{NH}_3 \rightarrow \text{NH}_4^+ + \text{C}_2\text{H}_3\text{O}_2^-$

Salts and pH range in water solution

- 1) A salt of a strong acid and a strong base will produce a solution with _____
- 2) A salt of a weak acid and a strong base will produce a solution with pH _____

- 3) A salt of a weak base and a strong acid will produce a solution with _____
- 4) A salt of a weak acid and a weak base produces a solution whose pH _____

Chemistry I: Acids and Bases Web Quest



Introduction

You are a consumer information specialist. You need to inform or warn consumers about the dangers of household chemicals. These are compounds that can be found in any home for any variety of household uses.

The Task

You will use the information you have learned about acids and bases to develop information that will be alert consumers in the home of how these compounds may harm them, their children or their pets. In order to do this you will need to:

- Define to the general public what makes a compound hazardous.
- Inform of what acids and bases can do to harm things
- Indicate to the consumer what these compounds do in the home.
- Advise consumers of where these compounds are usually found in the home
- Advise consumers of how these should be safely stored in the home.
- Advise consumers of what products have these compounds as a component.
- Develop a 2-sided fact sheet on the hazards associated with a particular group of household compounds.

Beginning Activities

Begin by looking at this web site:

<http://householdproducts.nlm.nih.gov/index.htm>

This web site is from the National Institutes of Health, National Library of Medicine. Use the information here to select a product category to research.

The Process

1. Working in groups of 2-3 people, select a category of products you wish to work with.
2. Next research the provided web sites to obtain basic information that you need to present in your fact-sheet.
 - a. http://www.healthgoods.com/Education/Healthy_Home_Information/Home_Health_Hazards/household_hazardous_products.htm
 - b. <http://householdproducts.nlm.nih.gov/products.htm>
 - c. <http://www.brgov.com/recycle/househazards.htm#Common>
 - d. http://www.avma.org/communications/brochures/hazards/household_brochure.asp
 - e. http://www.natural-healthy-home-cleaning-tips.com/potential_household_product_hazards.htm
 - f. http://www.natural-healthy-home-cleaning-tips.com/potential_household_product_hazards.htm
 - g. http://www.seventhgen.com/household_hazards/glossary.php?tid=13
 - h. <http://www.metrokc.gov/health/hazard/hazchems.htm>
 - i. <http://danpatch.ecn.purdue.edu/~epados/waste/src/references.htm>
3. The sheet should be a 12 pt double spaced word document on 8.5" by 11.0" paper. You may select the color of paper you like.
4. Put the fact sheet together:
 - a. Title
 - b. Introduction to household hazards.
 - c. Identify the category of products and what makes them hazardous.
 - d. State what these products are used for and what makes them a hazard.
 - e. Where are they found in the home
 - f. How should they be stored in the home
 - g. (Optional) what are some alternative non-hazardous products
 - h. Site your sources.

5. This assignment will be due on _____
6. Point value is 100 pts.

Learning Strategies

1. gather information about household hazards
2. select a group of products
3. identify compounds in the selected group
4. find information on the hazards of the compounds
5. gather information on how these compounds should be stored in the home

Household Hazards Project Rubric

Introduction	Value	Score
a) Title	5	
b) Introduction to household hazards	10	
Group of Compounds		
a) Identify the group of compounds	10	
b) what makes them hazardous	10	
c) State what these compounds are used for in the home	10	
Household Storage		
Where are they found in the home	10	
How they should be stored in the home	10	
Structure of Fact Sheet		
whole page (8.5x11) both sides	10	
Correct size font and double space	5	
Neat and easy to understand	10	
Site your sources	10	
Optional (alt. compounds) 5pts		
Total	100	